



Paléontologie générale (Biostratigraphie)
Découverte de Jurassique supérieur et d'un niveau marin
du Barrémien dans les « couches rouges » continentales
du Haut Atlas central marocain :
implications paléogéographiques et structurales

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Résumé

Des associations significatives de charophytes et d'ostracodes ont été récoltées dans l'unité médiane (formation des Iouaridène) des « couches rouges » continentales jurassico-crétacées du Haut Atlas central marocain. Dans son stratotype, situé dans le synclinal des Iouaridène, et aussi dans le synclinal de Ouauouzarht, la partie inférieure de la formation des Iouaridène a livré les charophytes *Porochara kimmeridgensis* et *Dictyoclavator ramalhoi*, permettant de dater, pour la première fois, une sédimentation continentale d'âge Jurassique supérieur (Oxfordien?–Kimméridgien) dans le Haut Atlas central. Par ailleurs, des ostracodes, récoltés dans la partie supérieure de la même formation, indiquent une ingression marine au Barrémien inférieur. Ces données biostratigraphiques permettent de préciser l'âge de certains niveaux à restes et traces de Dinosaures, d'améliorer les reconstitutions paléogéographiques, de reconnaître la position stratigraphique de deux épisodes d'épanchements magmatiques et de contraindre les modèles structuraux évolutifs de la chaîne Atlasique au Mésozoïque. Ainsi, le domaine central du Haut Atlas marocain peut désormais être intégré pendant le Jurassique supérieur et le Crétacé inférieur à la marge de l'Atlantique central en expansion. **Pour citer cet article : A. Charrière et al., C. R. Palevol 4 (2005).**

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Abstract

First record of the Upper Jurassic and of a marine Barremian intercalation in the continental 'redbeds' from the central Moroccan High Atlas: palaeogeographic and structural implications. Meaningful assemblages of charophytes and ostracods have been collected in the intermediate unit (Iouaridene Formation) of the Jurassic–Cretaceous 'redbeds' from the central Moroccan High Atlas. In the type locality of the Iouaridene syncline and also in the Ouauouzarht syncline, the lower part

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of the above-mentioned formation has yielded the charophytes *Porochara kimmeridgensis* and *Dictyoclavator ramalhoi*, allowing us to underline for the first time an Upper Jurassic continental sedimentation (Oxfordian?–Kimmeridgian) in the central High Atlas. Moreover, ostracods collected in the upper part of the formation quoted indicate an early marine ingression in the Lower Barremian. These biostratigraphic data allow us to precise the dating for the Dinosaurs' remains and tracks, to improve the palaeogeographical reconstructions, to recognize the stratigraphic position of two extrusive magmatic events B1 and B2 as well as to constrain the structural and evolutionary patterns of the Atlasic Belt during the Mesozoic period. **To cite this article: A. Charrière et al., C. R. Palevol 4 (2005).**

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Mots clés : « Couches rouges » continentales ; Charophytes ; Ostracodes ; Biostratigraphie ; Jurassique supérieur ; Barrémien ; Haut Atlas ; Maroc

Keywords: Continental 'redbeds'; Charophytes; Ostracods; Biostratigraphy; Upper Jurassic; Barremian; High Atlas; Morocco

Abridged English version

Geologic and stratigraphic framework

Since the Middle Jurassic to the Middle Cretaceous, continental 'redbeds' (Fig. 1A) were deposited on the main part of the Atlasic area (central and eastern High Atlas, Middle Atlas), whereas the place of the western High Atlas remained in marine coastal sedimentary conditions connected with the opening of the central Atlantic. The stratigraphic series of the 'redbeds' in the central High Atlas (Fig. 1B) is well known since the basic studies [14] used to elaborate the geologic maps of this area [17,19,21,25] and constituted by three successive lithologic formations: the Guettioua formation, with coarse sandstones and Dinosaur remains [27,28], the Iouaridene Formation, with more finely detrital sediments (silts, pelites, marls), and the Jbel Sidal Formation, mainly constituted by sandstones. These deposits apparently unfossiliferous were assigned to various stratigraphic positions from the Middle Jurassic (Bathonian?–Callovian) until to the Lower Cretaceous [26].

Our recent studies on the field (A.C. and H.H.) and micropalaeontological analyses (P.-O.M.) supplied however new biostratigraphic data in the intermediate unit of the 'redbeds' (Iouaridene Formation) with significant consequences for the cartography, the palaeontology and the palaeogeography.

Lithostratigraphy and new micropalaeontological data

Iouaridene syncline

In its stratotype [18], the Iouaridene Fm. is thick of about 1000 m. In its lower part, which was solely studied (section, Fig. 2 B), the bottom has yielded the charo-

phyte *Porochara hians* from the Dogger [5]. Above, red marls are overlapped by a set of repeated sequences with palaeosoils and mud-cracks, showing besides on its top remarkable Dinosaur tracks [9]. Still above, about 200 m from the bottom, we collected numerous microfossils, as lacustrine Ostracods (mainly *Cypridea suprajurassica* and *C. mohandi*), and charophytes, as *Porochara kimmeridgensis* and *Dictyoclavator ramalhoi*, which indicate undoubtedly the Kimmeridgian [10,22,23].

Ouaouizarht syncline

In the lower member of the Iouaridene Fm. (section, Fig. 3B), the first samples over the basalts B1 have supplied small shells of lacustrine bivalves (*Unio* sp.) and ostracods (*Cypridea* spp.) as well as gyrogonites of *Porochara kimmeridgensis* indicating the Oxfordian or the Kimmeridgian. Above, other samples (W3, W18, W19) allowed to find again the same lacustrine ostracods (*Cypridea* spp. and some others) and charophytes *Porochara kimmeridgensis* and *Dictyoclavator ramalhoi* from the Kimmeridgian. Furthermore, near Ouaouizarht (Fig. 3A and C, samples W39, W34), brown marly layers in the upper member of the same formation have yielded ostracods showing Eurasian and Gondwanian affinities as well as a mainly brackish palaeoenvironment and a Lower Cretaceous age, which is confirmed in sample W34 by marine ostracods *Trachyleberididae* linked to the Lower Barremian [23].

Biostratigraphy and correlations

The collection of *Porochara hians* in the bottom of the Iouaridene Formation is related to the Middle Jurassic, whereas the first marly sequence can be linked either to the Oxfordian or the Kimmeridgian and the

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